



OpenAIR@RGU

The Open Access Institutional Repository at Robert Gordon University

<http://openair.rgu.ac.uk>

This is an author produced version of a paper published in

Electronic Journal of Information Systems in Developing Countries (ISSN 1681-4835)

This version may not include final proof corrections and does not include published layout or pagination.

Citation Details

Citation for the version of the work held in 'OpenAIR@RGU':

DAHIRU, A. A., BASS, J. and ALLISON, I., 2014. Cloud computing: adoption issues for sub-Saharan African SMEs. Available from <i>OpenAIR@RGU</i> . [online]. Available from: http://openair.rgu.ac.uk

Citation for the publisher's version:

DAHIRU, A. A., BASS, J. and ALLISON, I., 2014. Cloud computing: adoption issues for sub-Saharan African SMEs. <i>Electronic Journal of Information Systems in Developing Countries</i> , 62 (1), pp. 1-17.
--

Copyright

Items in 'OpenAIR@RGU', Robert Gordon University Open Access Institutional Repository, are protected by copyright and intellectual property law. If you believe that any material held in 'OpenAIR@RGU' infringes copyright, please contact openair-help@rgu.ac.uk with details. The item will be removed from the repository while the claim is investigated.

CLOUD COMPUTING: ADOPTION ISSUES FOR SUB-SAHARAN AFRICAN SMES

A.D. Abubakar

Robert Gordon University,
Aberdeen, Scotland, UK
d.a.abubakar@rgu.ac.uk

Julian M Bass

Robert Gordon University,
Aberdeen, Scotland, UK
j.m.bass@rgu.ac.uk

Ian Allison

Robert Gordon University,
Aberdeen, Scotland, UK
i.allison@rgu.ac.uk

ABSTRACT

This paper explores the emergence and adoption of cloud computing by small and medium-sized enterprises (SMEs) and points towards its implications for developing countries in sub-Saharan Africa. Several studies have shown the importance of technologies to SMEs and the potentials of SMEs for economic growth. Using qualitative techniques we obtained and analysed data from ten SMEs that have adopted cloud computing as an IT strategy. These SMEs span across various sectors including finance, information and communication technology (ICT), and manufacturing in Nigeria, a developing country in sub-Saharan Africa. We found that, contrary to the literature on cloud computing adoption in the global north, these SMEs are less concerned with challenges like security, privacy and data loss rather; they continue to show optimism in using the potential opportunities that cloud computing presents to them. We envisage that as cloud computing evolves, more SMEs in sub-Saharan Africa will adopt it as an IT Strategy. This could positively contribute to the successes of these SMEs and consequently contribute to the economic growth desired by these developing countries.

KEYWORDS: Cloud Computing, Developing Countries, ICT, SMEs, Sub-Saharan Africa

1. INTRODUCTION

The ability to access computing resources or develop a robust IT infrastructure in developing countries has been difficult. Cloud computing as a new computing paradigm can now provide remote access to these resources that were otherwise inaccessible. The emergence of cloud computing will change the stakes for entrepreneurs, small and large businesses, and researchers and governments (Greengard, 2010). According to a recent IDC research, worldwide spending on public IT cloud services is expected to hit US\$100 billion in 2016 (IDC, 2013).

The focus of this paper is on the implications of this new paradigm on small and medium-sized enterprises (SMEs) in developing countries specifically Sub-Saharan Africa. Early investigations into the cloud readiness of countries in sub-Saharan Africa by Laverty (2011) showed that there is the potential for growth of at least one form of the cloud technology in the future. We view Nigeria as an early adopter in sub-Saharan Africa. Consequently, examining SMEs in Nigeria will indicate future adoption trajectory in the region.

The definitions of SMEs vary significantly with place and the economy concerned. The Central Bank of Nigeria (2010) defines SMEs as any enterprise which employs fewer than 199 persons and with a maximum turnover of N500 million (approximately US\$3.2 million) and assets of N50 million (approximately US\$320, 000) excluding land and working capital. SMEs are important for economic growth especially in developing countries (Beck et al., 2005; Smallbone & Welter, 2001; Huang & Palvia, 2001). Like most information and communication technology for development (ICT4D) or information systems (IS) researchers, we view development as structural societal change where diverse socio economic change is a key component (Tribe & Sumner, 2008).

According to Heeks (2010) however, whatever our particular understanding of development – ICTs are making a contribution. The United Nations Development Programme (2001) has also argued in favour of the potentials of technologies for improving performance in state institutions and other aspects of the economy. The implications of cloud computing to SMEs in sub-Saharan Africa are still unclear. It has the potential to enable access to technology in a way that could not have been possible few years back. SMEs are beginning to utilize this opportunity as cloud-based commercial services become increasingly prevalent. Marston et al. (2011) in giving the business perspective of the cloud identified SMEs as the major beneficiaries of this computing paradigm. It provides the opportunity for new entrants amongst the SMEs in various business sectors to leapfrog and compete with larger enterprises in the market. Gartner (2012) says that “...cloud computing will soon become the main strategy for many enterprises”. Overall, this could contribute to the economic growth desired by these countries.

This research work contributes to the literature on cloud computing as an emerging area by exploring the issues associated with its adoption by SMEs in Nigeria. We found that, contrary to the literature available on cloud computing adoption by SMEs in the global north, SMEs in Nigeria are less concerned with issues termed as challenges like security, privacy and data loss and continue to show optimism in leveraging the potential opportunities that cloud computing presents. We also found that there is the need for awareness and support of the top management staff regardless of the matrix hierarchy observed in the respective enterprises. These issues are derived from data collected from ten SMEs in Nigeria across various sectors including finance, information and communication technology (ICT), and manufacturing. To the best of our knowledge there has not been any previous publication to that effect to date.

Being a relatively new area, a grounded theory approach is used as research methodology. Hence the issues discovered were allowed to emerge from the data without forcing any preconceived ideas on the data.

This paper is organized into five further sections. Preliminary literature review is discussed in the next section as related work. In section three, the research methodology is discussed. Findings from this research are presented in section four and discussed in section five. Finally, the conclusion and further work are presented in section six.

2. RELATED WORK

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell & Grance, 2011). Cloud computing is also defined as “a parallel and distributed computing system consisting of a collection of inter-connected and virtualised computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements (SLA) established through negotiation between the service provider and consumers” (Voorsluys et al., 2011, p. i-xxv). Users can then have access to highly scalable and reliable computing services that can be measured by these SLAs. Simply put, cloud computing is where service providers make available software and technology as services (computing and storage) over the internet. The end-user does not require the knowledge of the physical location and configuration of the system that delivers the services. Ambrust et al. (2010) have summarized the key characteristics of cloud computing as: “(1) the illusion of infinite computing resources available on-demand; (2) the elimination of an up-front commitment by cloud users whereby resource allocation can be adjusted; and (3) the ability to pay for the use of computing resources when needed”.

Examining the issues associated with cloud computing adoption will play a vital role in the successful adoption and implementation process. Kim et al. (2009) have examined issues that could impede the rapid adoption of cloud computing from the perspective of potential users with more emphasis on medium to large users. Important as the issues raised may be however, the study requires strong justifications on how those issues were arrived at and the very many predictions that were made concerning cloud computing adoption. Neves et al. (2011) have also used Political, Economic, Social and Technological (PEST) analysis to identify issues associated with cloud computing adoption by SMEs and suggests how they can cope with these issues. The analysis, conducted by scoping published literature however, only provided external issues associated with cloud adoption disregarding the impact on organizations' behaviour.

In sub-Saharan Africa, internet broadband, economic development, and security privacy and trust are the emerging issues related to the use of cloud computing identified by the South African internet governance forum in 2011 (Alex, 2011). The forum, however, did not carry out a detail analysis of these emerging issues and therefore could not provide or inform any sort of user or policy recommendations in terms of using the cloud. In a related work, (Le Roux & Evans, 2011) have shown how cloud computing could bridge the digital divide in secondary education in South Africa. They cited lack of political will and determination amongst other issues as key factors responsible for widening the digital divide. The study was based on a review of cloud computing applications and services, currently used by secondary education systems in developed countries. It however does not address actual adoption issues faced by these education institutions as it was more of a readiness, availability and uptake studies rather than impact as Heeks (2010a) categorized. Kshetri (2011), on a general note, propounds that the findings on the potentials and impact of cloud computing to companies in the developing world are inconsistent. According to the same study, the greatest barrier to adoption and effective utilisation of cloud computing centres on level of penetration of the PC and on the availability of good internet connection. The study did not examine or identify organisations' cloud adoption decisions but pointed it out for future research.

Cloud computing is already being used in numerous ways such as free email services like that of Gmail and Yahoo mail. Peachtree accounting package, Enterprise Resource Planning (ERP) and SAP are example of other application services hosted in the cloud. Cloud computing services, *cumulus*, reported to be designed specifically for SMEs has recently been launched in some sub-Saharan African countries (McLeod, 2013). MTN, one of the largest mobile telecommunication companies is now providing a range of cloud computing services for SMEs in Nigeria and Ghana (SAinfo reporter, 2013).

Few studies however, have shown the direct impact of other ICTs to development (Heeks 2010a). In sub-Saharan Africa, Jagun et al. (2008) have conducted an in-depth case study on the impact of mobile telephony in the supply chain of the cloth-weaving sector in Nigeria to which they found evidence for the benefits of such usage. Using Sen's capability approach, Ibrahim-Dasuki et al. (2012) have also studied the impact of ICT investments on development citing the failure of the Nigerian pre-paid electricity billing system to fully achieve its potential. To the best of our knowledge no study has been carried out to examine the use of cloud computing or to show the direct impact of cloud computing adoption to actual SMEs or its impact on economic growth in developing countries. In summary, cloud computing is still in its infancy stage both in the global north and south and there are potential areas that are yet to be explored. Thus, this paper contributes in filling the literature gap identified in this emerging area.

3. METHODOLOGY

The research methodology followed in this study is that of grounded theory (GT). The first definition of grounded theory as put forward by the proponents of the method Glaser and Strauss (1967) is – “the discovery of theory from data” (p. 1). It is a qualitative approach that has been variously described as positivist, interpretive or critical (Urquhart et al., 2010). Grounded theory has been used in the IS field; Orlikowski (1993), for example in investigating the use of Computer Aided Software Engineering tools in organizations. Matavire and Brown (2008) have identified four main grounded theory approaches in IS research. These approaches include the two distinct strands of GT that have been openly debated by Corbin & Strauss (1990) and Glaser (1992) the proponents of the method. The primary differences of these 2 strands are on the “coding style, families and paradigm” (Sulayman et.al, 2012). Specifically, our research adopts the “Glaserian” or classical grounded theory approach with an interpretive viewpoint mainly because of its usefulness when studying relatively new areas (Stern, 1994) as is the case with cloud computing technology and its adoption in sub-Saharan Africa. More so, its coding procedure is simpler to use and closer to the original version (Urquhart et al, 2010). To determine an area of research in the broad topic of cloud computing, a literature review was conducted just enough to allow for the development of an interview guide for data collection and for interaction with participants in the study on the subject of cloud computing. This is in accordance with the recommendations of GT by Glaser (2004), which insist that “undertaking an extensive literature review before the emergence of the core category can violate the basic premise of GT”.

To carry out the literature review, initial literature survey to find out what is being published by high ranking journals in the IS field on cloud computing adoption by SMEs in Sub-Saharan Africa was conducted. Most of the journals consulted¹ returned 0-2 publications on this research area which suggests that serious publishing in this subject area has not yet started. The searches were restricted to English language documents, within the time frame 2005 to 2011. The various searches carried out also resulted in some other related publications most of which were found to be either practitioner oriented and appeared only on academic magazines or basically required stronger justification. Other publications found were merely just contributing to the advocacy and hype on cloud usage. An updated literature survey was carried out in mid-2013 in the same high ranking journals and in ICT4D journals² as ranked by Heeks (2010b) and no new publications have emerged so far that distinguishes the results from the initial findings. This paper begins to fill the literature gap by investigating the cloud computing adoption issues to actual companies (SMEs) in sub-Saharan Africa.

3.1. Research Sites

The research sites chosen for this study is made up of small and medium-sized enterprises in Nigeria. The International Telecommunication Union (ITU) 2011 ICT statistics report showed that Nigeria is the second country after South Africa, in sub-Saharan Africa, with the highest number of fixed internet broad band subscription and first in the number of total mobile broadband subscription (International Telecommunication Union, 2011). Nigeria also has a positive broad band strategy that has resulted in the increase of teledensity from 8.5 per cent in 2004 to 64.7 per cent in April 2011, thus representing over 90 million active telephone lines (ITU, 2012a). This created a larger market opportunity for cloud service providers as well as a hub for providing cloud computing services to surrounding countries. Thus we

¹ IS Journals consulted include but were not limited to MISQ, ISJ, JMIS, JSIS, ISM (see appendix - 1 for details)

² ICT4D journals consulted include but were not limited to ICTD, ITID, EJISDC, ITD, AJIC (see appendix - 1 for details)

envision that a look at Nigeria will give an insight into the future adoption trajectory of other sub-Saharan African countries like Kenya, Uganda, Zimbabwe, Ghana, Cote d'Ivoire, Senegal and Zambia that have also been reported amongst the ten largest internet using population in Africa. An earlier investigation by Lavery (2011) into the cloud readiness of these countries also showed Nigeria as one of the countries that satisfies the indicators for the growth of at least one form of the cloud technology in the future. SMEs in Nigeria were also chosen because of the availability and accessibility of a favourable government national policy on SMEs that contains a blueprint of SME development through the use of information and communication technology (ICT) as a strategy for success. The policy seeks to make SME a driver for national economic growth (Small and Medium Enterprises Development Agency of Nigeria & United Nations Development Programme, 2007). This policy is similar to what is obtainable in the South Africa and Botswana SME policy. There is also an information and communication technology for development (ICT4D) strategic action plan for implementing an existing national information technology (IT) policy that seeks to make IT a driver for sustainable development (National Information Technology Development Agency & United Nations' Economic Commissions for Africa, 2008). Again, this is similar to the government of Rwanda's focus on making ICT a driver of economic growth. Also, according to SMEDAN and UNDP (2007), much of the growth of SMEs in the electronic and information technology sub-sector in Nigeria is based on outsourcing from developed economies.

To inform the selection/sampling of the research sites, pieces of information gathered from initial research sites are used. This is also referred to as theoretical sampling in GT (Glaser, 1978). Participants are also requested to provide information regarding similar enterprises like theirs that they are aware of to further guide the researcher to more SMEs using cloud hosted services as part of their IT strategy. This and the theoretical sampling method led to the selection of enterprises across different industries in Nigeria including IT, manufacturing, finance, networking and telecoms. Seven of the enterprises interviewed use enterprise resource planning (ERP), SharePoint or accounting packages hosted in the cloud. All of the enterprises use cloud hosted email services while three use other applications and data storage services hosted in the cloud. A summary of the profiles of the SMEs are presented in Table 1.

Table 1. A Summary of the Profiles of the SMEs

	Domain	No of Employees	Assets in Thousands of Dollars Excluding Land & Building	Age	Cloud Hosted Service
SMEs					
SME-A	IT	7 – 10	< 30	2	Email, Storage
SME-B	Manufacturing	40 – 50	30 to 300	7	Email, PeachTree
SME-C	IT/Training	40 – 50	< 30	9	Email, Storage
SME-D	Finance	140 – 150	300 to < 3000	8	Email, ERP, CPAS
SME-E	Finance	80 – 90	300 to < 3000	7	Email, ERP, CPAS
SME-F	Finance	40 – 50	300 to < 3000	8	ERP
SME-G	Networking	35 – 40	300 to < 3000	13	Email, Service-desk, SharePoint Storage
SME-H	Telecoms	50 – 60	300 to < 3000	10	CRM, Email, ERP
SME-I	Networking	120 – 130	300 to < 3000	10	CRM, Email, ERP
SME-J	Networking	60 – 75	300 to < 3000	16	Email, Storage

3.2. Data Collection

Data was collected from the research sites through open-ended face-to-face semi-structured interviews and supported by observations. An interview guide that introduces the topic of discussion and a consent form was provided before the beginning of each interview. The structure of the open-ended interview and the development of the interview guide follow Patton's (2005) qualitative interviewing strategies. While all the participants were asked the same basic questions³ which were prepared in advance, the exact wordings and sequence of questions were determined in the course of the interviews. Participants were also assured that any data used for publication will be anonymized. A total number of ten SMEs and twelve participants comprising of two Chief Executive Officers (CEOs), four Chief Technology Officers (CTOs) and six Information Systems (IS)-staff were interviewed. The interviews were conducted in their office premises in English language. English is not their first language but all participants were fluent. The interviews lasted between 30-40 minutes. The interviews were conducted mainly to find out the participants' views and experiences in using cloud computing as part of their strategic IT practices. Some of the participants were interviewed twice or contacted over the phone to verify or clarify information. Two participants were not comfortable giving out information about costs and decision making issues without first checking with their superiors. All the interview sessions were audio-recorded except for one CTO who declined the request to be recorded. For that one participant, notes were taken and written up immediately after the interview session. The interviews were then carefully transcribed. To ensure accuracy, the audio records were listened to again and the transcripts inspected for errors.

³ A sample of some of the interview questions is attached in appendix - 2

3.3. Data Analysis

As stated above, data analysis was carried out using ‘Glasserian’ grounded theory approach which involved using key point coding to derive concepts and categories by method of constant comparison. Dey (1999), in giving the definition of grounded theory asserts that data analysis is systematic and begins as soon as data is available and involves identifying categories and connecting them (cited in Urquhart 2001). Using the key-point style of coding as described by Allan (2003), significant points emanating from the investigation were identified from the transcripts of the interviews. The transcripts were written in tabular form thus distinguishing the comments made by either the interviewer or interviewee. Identifiers (P1, P2...) are used for each significant point identified within the text of a specific interview transcript, where ‘P’ indicates a key-point. Key-points that are repeated in the same interview are assigned a suffix, for example ‘P1a’. Also, to distinguish between the various research sites, a generated subscript is used; ‘P_{ERC}1’ for example. After identifying a key-point, it is then italicised before being extracted to a table and grouped together with other key-points where they are assigned codes. This is to enable easy tracking of the key-points right back into the transcripts. Subsequent transcripts from other research sites are treated in a similar way. Table 2 gives a preview of some of the key-points and codes generated from selected interview transcripts.

Table 2. Key-Points to Codes

ID	Key-points	Codes
P _{ERC} 9	<i>“I can’t say it is 100% secure... but it’s for easy accessibility, it give me what I need”</i>	Security concerns Usage despite security concerns
P _{ERC} 14	<i>“New innovation comes from technical and training and then from marketing”</i>	Organized research and development
P _{MA} 2a	<i>“We needed to back them up on the cloud because of power issues”</i>	Data Access/Loss alternative Power (electricity) issues

The table shows the key point identifiers on the left-hand column. As stated earlier identifiers in the form ‘P_{MA}2a’ for example indicates repetition of the key-point ‘P_{MA}2’. The text of the key-point collected from the transcripts is shown in the middle column. The assigned codes are shown in the right-hand column of the table. The process described above is also known as open-coding in grounded theory. Similar codes are then grouped together by method of constant comparison (Glaser and Strauss, 1967). This is achieved by comparing the codes that arose from one interview against codes from the same interview and those from other interviews. This resulted into a higher level of regrouped codes called concepts as shown in table 3.

Concepts	Frequency of occurrence / comparison with other codes
Efficient Service delivery	13
Availability of good Internet connection	6
Cost issues	11
Security issues	13
Concerns about privacy and trust	5
Data loss concerns	6
Management support issues	28

Table 3. Codes to Concepts

By applying the constant comparison method to the concepts, some core categories emerged from the groups. The data from the transcripts were revisited several times and key-points compared with the categories that emerged until no more key points could be picked out from the data. This iteration ensured that theoretical saturation is reached and the coding and conceptualization can end. At the end of the categorization, three major categories emerged from the data as will be described in the findings section.

4. FINDINGS

We present a grounded theory of cloud adoption issues by small and medium-sized enterprises (SMEs) in Nigeria. The findings are outcomes of the analysis carried out as shown in the data analysis section above and they form the basis for the contributions of this paper.

4.1 Security, Privacy and Trust Issues

One of the main issues surrounding Cloud Computing adoption is security (Carlin & Curran, 2011; Ohlman et al., 2009). The fact that cloud computing takes place over/across a network where users are able to gain access to computing resources via the internet from anywhere makes it ‘appear’ more vulnerable to all forms of cyber-attacks. Security has been cited in various surveys on cloud computing adoption in the global north as one of the key challenges that is keeping end-users away from adopting any form of the cloud (Shaikh & Haider, 2011; Gens et.al, 2009). We identified a different trend amongst the SMEs that participated in this research. Most of the companies’ CTOs or IS staff do not see security as a major threat or an obstacle in adopting the cloud. Consider this statement by one of the interviewees when asked about his thoughts on security in the cloud: “*it is secured*” [Interviewee 3]. Another interviewee is of the opinion that: “*cloud computing is secured... because we have not experienced any threat so far*” [Interviewee 10]. Furthermore, even those that did actually express their fears about security are still using it (cloud computing) as part of their IT-Strategy, like this interviewee who said concerning cloud security: “*I can’t say it is 100% secure... but it’s for easy accessibility, it give[s] me what I need*” [Interviewee 1].

Privacy and trust is another important component of this category. It is significant to differentiate between security and privacy because while security is about the vulnerability of your data in the cloud and the fear of attacks by third parties, privacy is more of the breach of

trust by the cloud service provider of your official or personal information. According to 9 out of the 12 interviewees, they do not harbor such fears. This is evident from some of their statements: *“We trust them [Service providers], they have never failed us... they are credible” [Interviewee 2]*. In another interviewee’s opinion, *“if there is a guarantee from the providers, there is no fear at all” [Interviewee 10]*. One of the 3 participants that expressed concerns about privacy and trust views it as an issue that will only arise when *“getting people to actually put stuff into it (cloud)” [Interviewee 4]*, and is happy with *“having software (applications) that you can be able to use from a remote point that you can share with others easily” [Interviewee 4]*.

4.2 Data Loss Concerns

Unanticipated loss of information or data is another concern when using the cloud. This issue has been a source of concern even before the advent of cloud computing. The interviewees did not express such deep concerns regarding this issue, and do not see it as an obstacle that could prevent them from adopting cloud computing. This is also evident from their statements *“I don’t fear loss of data in the cloud..., where we are having fear from is if there is an [electric power] outage and all our data is in the same location” [Interviewee 4]*. Most SMEs in Nigeria experience one form of electric power outage or the other and have turned to the cloud technology as alternative in preventing data loss, like one interviewee noted: *“we needed to back them up in the cloud because of [electric] power issues” [Interviewee 3]*. Also in the view of other interviewees:

“We never had problem or information loss... and in times of disaster like fire outbreak, all our documents will still be intact somewhere else” [Interviewee 2].

“There is usually no loss of data when using the system and there’s an outage, this is good” [Interviewee 7].

4.3 Awareness and Top Management Support Issues

Another issue with cloud adoption by SMEs is awareness and support of the companies’ top management. The need to know what cloud computing is and what benefits their companies stand to gain by adopting this technology is important in determining the adoption of the cloud model. One CTO expressed his view accordingly *“...it is difficult to get the ‘buying’ [consent] from the top [management]” [Interviewee 5]*. Thus they were unable to move to the cloud fully despite the benefits it presented to their business. Another CTO also in charge of implementing IS explained that *“...the management have to be convinced that moving to the cloud is strategically good for their business” [Interviewee 12]*. The Management team also plays a vital role in the cloud implementation process as related by this interviewee *“...the management are really interested in ideas that seek to automate core business process” [Interviewee 6]*. This in turn led to a successful implementation. All the interviewees agree that decision making is entirely up to the CEOs. This is evident from some of their statements:

“...the decision makers are mostly the management” [Interviewee 8].

“We sit at department[al] level and deliberate... ...if they [Top Management] are cleared about everything, they now take decision” [Interviewee 2]

“...decision making? Well, basically it comes from the top... decision is carried out by the [management] board” [Interviewee 4]

4.4 Availability of Good Internet Connection

As stated in the related work section (Kshetri 2011; Alex, 2011), the availability of good internet connection is one of the key emerging issues that needs to be addressed for the

effective use of cloud computing in developing economies. Also, According to the ITU (2012b) report on cloud computing in Africa, the most commonly used speeds for cloud computing services which are currently n*2 Mbit/s with xDSL technology and n*10 Mbit/s with Ethernet have not yet seen much development in Africa. When asked what challenges they are facing in the use of their SaaS cloud applications, six of the participants first mentioned the lack of good internet connection as a particular problem. *“The only challenge is the bandwidth, what the ISP [Internet Service Provider] you are using is giving at that time”* according to [Interviewee 9]. This causes the enterprises to move from one internet service provider to another in search of better internet service that will meet the requirements of their systems and ultimately the services they deliver as can be seen from the statement of these interviewees:

“Most of the challenges we face at-times is in terms of bandwidth... ..in fact we even changed the ISP” [Interviewee 2]

“The only problem is from the internet service providers... because the (internet) network fluctuates sometimes” [Interviewee 10]

Another fall back is also the use of mobile broad band internet services provided by GSM mobile service operators which could be more expensive.

4.5 Cost Issues

The pay-per-usage model and the scalability characteristics of cloud computing no doubt offers tangible benefits to cloud users. For SMEs in sub-Saharan Africa, the elimination of the upfront cost required for setting up IT infrastructural resources and reduced maintenance cost are key issues considered when using the cloud. [Interviewee 4] noted that *“It [cloud computing] helps to reduce your maintenance cost and your personnel expertise”*. Using the cloud has also brought about a reduction in the license fees these SMEs purchase all the time from software vendors. At the same time, the cost of maintaining huge computing resources that relies heavily on electricity which is highly unreliable in many places in Africa is partially mitigated. This is as expressed below by one of the interviewees:

“it is cheaper to use the cloud especially here where there is a lot of power failure and since we are a solutions company we need to buy the enterprise license for our software[s] all the time” [Interviewee 3]

5. DISCUSSION

Two of the three categories that finally emerged; security, privacy and trust, and data loss concerns as shown in the findings section above, all have one thing in common. They present a different perspective from what has been observed or documented in the literature and surveys as obstacles to cloud computing adoption especially in the global north. However, some of the other issues that arose from studying the data were as expected as can be found in similar studies on new ICTs in SMEs for example (Huang & Palvia, 2001) in investigating issues concerning ERP implementation in advanced and developed countries. Thus, stating them as issues relating to cloud computing adoption and implementation is apparent. These issues are about efficient service delivery, cost issues, the availability of good internet connection and cultural and infrastructural issues. Furthermore, as stated in the related work section, some of the cloud computing adoption issues are identified only as external factors and did not really consider organizations' adoption decisions or were not grounded in data.

Several studies and surveys have shown security as one of the major challenge that is keeping end-users away from the cloud for example (Shaikh & Haider, 2011) and (Gens et.al., 2009). This is contrary to the findings from the SMEs we investigated in Nigeria as can be inferred from the findings section above. Security in the cloud model does not seem to pose a major threat to these SMEs as far as adoption is concerned, likewise the issue of

privacy and trust. Pearson & Benameur (2010) have also raised several issues associated with privacy and trust including lack of user control and unauthorized secondary usage. We observed that fear of data mismanagement by individuals handling the data before it is put on the cloud outweighs that of the cloud service providers. Findings from this study have also shown that corporate data has been put on the cloud without recourse to its sensitivity. Like the security issue, the organizations were more concerned on rapidly leveraging on the cloud technology to support the delivery of efficient services.

Three main reasons can be attributed to this developing trend amongst these SMEs. Firstly, and most importantly is that the security provided in the cloud is in reality better than their in-house IT security environment. This means that the cloud model is providing a more secured environment for their business processes. Ambrust et al. (2010) have argued that “encrypting data before placing it in a cloud may be even more secured than unencrypted data in a local data centre”. Secondly, these SMEs are more concerned about the efficient service delivery experience in the cloud and the amount of computing resources they are able to leverage as compared to their traditional in-house IT infrastructure. Thirdly, which could be general to all the other issues raised in this research, is that cloud computing is still in its infancy stage and the adoption hype is still on. Consequently, some of the realities associated with the cloud model usage are not yet clear to these SMEs let alone influence their adoption decisions.

The difficulty of extracting data from the cloud is raising concerns and preventing organizations from adopting the cloud (Ambrust et al. 2010). Also, in a survey in 2009, 43 out of 62 SME responses saw “loss of control of services and/or data” as being an important concern in determining their approach to cloud computing adoption (ENISA, 2009). Findings from this research however, show that data loss concerns do not necessarily preclude the use of the cloud model by SMEs in sub-Saharan Africa. For these SMEs, the fear of loss of data in in-house IT system far outweighs the fear of loss of data in the cloud especially with the incessant electric power outages they experience. The cloud to them provides a solution to some of the infrastructural and cost issues associated with maintaining their IS.

Like many studies on new ICTs in SMEs (Newman & Zhao, 2008; Thong et al., 1996) for example, support of the top management has been found to be a recurrent factor linked to successful adoption and implementation. There is the need for awareness and support of the top management regardless of the matrix hierarchy observed in the organizations. As stated in the findings section, respective CTOs or IS-staff can only propose the adoption of new technologies but the final decision making lies with the management team of these organizations. Thus, failure to gain the support of the executive could be a barrier to successful adoption. We observed that some CEOs were yet to fully understand what cloud computing is. To manage this gap, establishment of a research and development unit either formally or informally became necessary for these organizations. The units are responsible for creating awareness about new technologies to both staff and executive. The emphasis by the participants in this investigation made this issue outstanding and more important than issues like availability of good internet connection or infrastructural issues which also play key roles in the adoption process.

6. CONCLUSION

Cloud computing is an emerging technology that is yet to be fully explored. We have established that there is limited number of reputable resources to consult concerning adoption of cloud computing by SMEs especially in sub-Saharan Africa. This lack of prior work indicated a gap in the literature. But findings from this research have identified some important issues relating to the adoption of cloud computing by SMEs which sharply contrast with studies on cloud computing adoption in the global north. Whereas security, privacy and

trust of data were found to be leading in determining the decision to adopt cloud computing in the global north, SMEs data were collected from in Nigeria, a sub-Saharan African country were less concerned with the security and privacy challenges in the cloud. On the contrary, these SMEs are more concerned with the huge amount of computing resources they hitherto did not have access to but are made available by cloud computing. Also, it provided a solution to most of these SMEs regarding loss of data in their in-house IT environment due to incessant electric power outages while at the same time reducing the cost of business. Top management awareness and support however, proved to be a constant recurrent issue that plays a vital role in determining cloud computing adoption by SMEs in both the global north and south.

While we did not find the direct impact of cloud computing to development, any generalized conclusion will be early at this stage. However, the potential opportunities cloud computing offers to SMEs are seemingly real. Its ability to lower the cost of entry by reducing the initial capital required for start-up of new SMEs or the cost of system management for existing once has been shown to be true. So also has the provision of wider access to the products and services of these SMEs. Thus, the further evolution of cloud computing as a new IT strategy will see to the engagement of more SMEs in sub-Saharan Africa with the cloud paradigm. This will in turn impact on the development of the SME sector as a strategy for economic growth. Consequently, the direct impact of adopting cloud computing technology on economic growth could be measured and understood through its use by these SMEs.

As further work, we will propose and adopt an ICT4D analytical framework that will seek to explore other aspect of cloud computing adoption issues like legal and regulatory issues, ICT policy issues, and institutions and capabilities issues that arise when using the cloud to determine how they influence adoption decisions and more so how the technology will impact on development in sub-Saharan Africa.

REFERENCES

- Allan, G. (2003) A Critique of Using Grounded Theory as a Research Method, *Electronic Journal of Business Research Methods*, 2, 1, 1-10.
- Alex, C. (2011) Emerging Issues: Cloud Computing. <https://www.apc.org/en/system/files/1.CloudComputing.pdf>
- Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I. and Zaharia, M. (2010). A View of Cloud Computing, *Communications of the ACM*, 53, 4, 50-58.
- Beck, T., Demircuc-Kunt, A. and Levine, R. (2005) *SMEs, Growth, and Poverty: Cross-Country Evidence* Springer Netherlands.
- Buyya, R., Yeo, C. S. and Venugopal, S. (2008) Market-oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities. *10th IEEE International Conference on High Performance Computing and Communications*, 5-13.
- Carlin, S. and Curran, K. (2011) Cloud Computing Security, *International Journal of Ambient Computing and Intelligence*, 3, 1, 14-19.
- Central Bank of Nigeria. (2010) *Prudential Guidelines for Deposit Money Banks in Nigeria*. <http://ndic.org.ng/files/Prudential%20Guidelines%205%20May%202010%20Final.pdf>.
- Corbin, J.B. and Strauss, A.C. (1990) *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, Sage: New York.
- European Network and Information Security Agency (2009) *An SME Perspective on Cloud Computing*. <http://www.enisa.europa.eu/activities/risk-management/files/deliverables/cloud-computing-sme-survey>

- Gartner (2012) *Gartner Special Report on Cloud Computing*. <http://www.gartner.com/technology/research/cloud-computing/index.jsp>
- Gens, F., Mahowald, R., Villars, R.L., Bradshaw, D. and Morris, C. (2009) *Cloud Computing 2010: An IDC Update*. <http://www.slideshare.net/JorFigOr/cloud-computing-2010-an-idc-update>
- Glaser, B.G. (1992) *Emergence vs Forcing: Basics of Grounded Theory Analysis*, Sociology Press.
- Glaser, B.G. and Strauss, A.C. (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Aldine de Gruyter
- Glaser, B. and Holton, J. (2004) Remodeling Grounded Theory. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 5, 2, 22 pages: <http://www.qualitative-research.net/index.php/fqs/article/view/607/1316>
- Greengard, S. (2010) Cloud Computing and Developing Nations, *Communications of the ACM*, 53, 5, 18-20.
- Heeks, R. (2010a) Do Information and Communication Technologies (ICTs) Contribute to Development? *Journal of International Development*, 22, 5, 625-640.
- Heeks, R. (2010b) An ICT4D Journal Ranking Table. *Information Technologies & International Development*, 6, 4, 71-75.
- Huang, Z. and Palvia, P. (2001) ERP Implementation Issues in Advanced and Developing Countries, *Business Process Management Journal*, 7, 3, 276-284.
- Ibrahim-Dasuki, S., Abbott, P. and Kashefi, A. (2012) The Impact of ICT Investments on Development Using the Capability Approach: The Case of the Nigerian Pre-paid Electricity Billing System. *The African Journal of Information Systems* 4, 1, 31-45.
- International Telecommunications Union ITU (2011) *ICT Data and Statistics (IDS)* <http://www.itu.int/ITU-D/ict/statistics/explorer/index.html>
- International Telecommunications Union ITU (2012a) *Nigeria's Broadband Strategy: The Open Access Model*. <http://www.itu.int/net/itunews/issues/2011/05/25.aspx>
- International Telecommunications Union ITU (2012b) *Cloud Computing in Africa: Situation and Perspectives*. http://www.itu.int/ITU-D/treg/publications/Cloud_Computing_Afrique-e.pdf
- Jagun, A., Heeks, R. and Whalley, J. (2008) The Impact of Mobile Telephony on Developing Country Micro-enterprise: A Nigerian Case Study. *Information Technologies & International Development*, 4, 4, 47-65.
- Kim, W., Kim, S. D., Lee, E. and Lee, S. (2009) Adoption Issues for Cloud Computing. *Proceedings of the 11th International Conference on Information Integration and Web-Based Applications & Services*, Kuala Lumpur, Malaysia. 3-6.
- Kshetri, N. (2010) Cloud Computing in Developing Economies, *Computer*, 43, 10, 47-55.
- Kshetri, N. (2011) Cloud Computing in the Global South: Drivers, Effects and Policy Measures, *Third World Quarterly*, 32, 6, 997-1014.
- Laverty, A. (2011) The Cloud and Africa – Indicators for Growth of Cloud Computing African File. <http://theafricanfile.com/academics/usc/the-cloud-and-africa-indicators-for-growth-of-cloud-computing/>
- Le Roux, C. and Evans, N. (2011) Can Cloud Computing Bridge the Digital Divide in South African Secondary Education? *Information Development*, 27, 2, 109-116.
- McLeod, C., (2013) *Cloud Computing Service for SMEs Launched in Uganda*. <http://www.technologybanker.com/it-ops/cloud-computing-service-for-smes-launched-in-uganda#.UgtlubXFV8E>
- Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J. and Ghalsasi, A. (2011) Cloud Computing: The Business Perspective, *Decision Support Systems*, 51, 1, 176-189.

- Matavire, R. and Brown, I. (2008) Investigating the Use of Grounded Theory in Information Systems Research. *Proceedings of the 2008 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists on IT Research in Developing Countries: Riding the Wave of Technology, Wilderness, South Africa*. 139-147.
- Mell, P. and Grance, T. (2011) The NIST Definition of Cloud Computing (draft) *NIST Special Publication*, 800, 145.
- Nabil Ahmed, S. (2011) Reaching for the “Cloud”: How SMEs Can Manage. *International Journal of Information Management*, 31, 3, 272-278.
- Nabil, S. (2010) Cloud Computing for Education: A New Dawn? *International Journal of Information Management*, 30, 2, 109-116.
- National Information Technology Development Agency & United Nations’ Economic Commissions for Africa. (2008) *The Nigerian Information and Communication Technologies for Development (ICT4D) Plan*. Abuja, Nigeria
- Neves, F.T., Marta, F.C., Correia, A.M.R. and Neto, M.C. (2011) The Adoption of Cloud Computing by SMEs: Identifying and Coping with External Factors, 11th Conference of the Portuguese Association for Information Systems, Lisbon, 19th-21st Oct. http://run.unl.pt/bitstream/10362/6166/1/Neves_Marta_Correia_Neto_2011.pdf
- Newman, M. and Zhao, Y. (2008) The Process of Enterprise Resource Planning Implementation and Business Process Re-engineering: Tales from Two Chinese Small and Medium-sized Enterprises, *Information Systems Journal* 18, 4, 405-426.
- Ohlman, B., Eriksson, A. and Rembarz, R. (2009) What Networking of Information Can Do for Cloud Computing. 18th IEEE International Workshop on Enabling Technologies: Infrastructures for Collaborative Enterprises 78-83.
- Orlikowski, W.J. (1993) CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development, *MIS Quarterly*, 17, 3, 309-340.
- Patton, M.Q. (2005) *Qualitative Research*. John Wiley & Sons, Ltd.
- Pearson, S. and Benameur, A. (2010) Privacy, Security and Trust Issues Arising from Cloud Computing. *Second IEEE International Conference on Cloud Computing Technology and Science*, 693-702.
- SAinfo reporter (2013) *MTN Launches Cloud Services for SMEs*. <http://www.southafrica.info/business/trends/newbusiness/mtn-110413.htm#.UhH8ObXFV8E>
- Shaikh, F. B. and Haider, S. (2011) Security Threats in Cloud Computing. *International Conference for Internet Technology and Secured Transactions*, 214-219.
- Small and Medium Enterprises Development Agency of Nigeria and United Nations Development Programme. (2007) *National Policy on Micro, Small and Medium Enterprises*. Abuja, Nigeria
- Smallbone, D. and Welter, F. (2001) The Role of Government in SME Development in Transition Economies. *International Small Business Journal* 19, 4, 63-77.
- Stern, P.N. (1994) Eroding Grounded Theory, in: Morse, J. (Ed). *Critical Issues in Qualitative Research Methods*, Sage: Thousand Oaks, 212-223.
- Sulayman, M., Urquhart, C., Mendes, E. and Seidel, S. (2012) Software Process Improvement Success Factors for Small and Medium Web Companies: A Qualitative Study. *Information and Software Technology* 54, 5, 479-500.
- Thong, J.Y.L., Yap, C.S. and Raman, K.S. (1996) Top Management Support, External Expertise and Information Systems Implementation in Small Businesses. *Information Systems Research* 7, 2, 248-267.
- Tribe, M.A. and Sumner, A. (2008) *International Development Studies: Theories and Methods in Research and Practice* Sage Publications Limited.

- United Nations Development Programme (2001) Making New Technologies Work for Human Development. New York. UNDP
- Urquhart, C. (2001) An Encounter with Grounded Theory: Tackling the Practical and Philosophical Issues, in: Trauth, E. (Ed). *Qualitative Research in IS: Issues and Trends*, IGP, 104-140.
- Urquhart, C., Lehmann, H. and Myers, M.D. (2010) Putting the 'Theory' Back into Grounded Theory: Guidelines for Grounded Theory Studies in Information Systems, *Information Systems Journal* 20, 4, 357-381.
- Voorsluys, W., Broberg, J. and Buyya, R. (2011) Introduction to Cloud Computing, In: Buyya, R., Broberg, J. and Goscinski, A. (Eds) *Cloud Computing*, John Wiley & Sons, Inc. 1-41.

APPENDIX – 1

IS Journals Consulted

MISQ – Management Information Systems Quarterly
 ISJ – Information Systems Journal
 JMIS – Journal of Management Information System
 JSIS – Journal of Strategic Information System
 ISM – Information Systems Management
 ATIS – ACM Transaction of Information Systems
 IJWGS – International Journal of Web and Grid Services
 ISF – Information Systems Frontier
 EJIS – European Journal of Information Systems
 INFOR

ICT4D Journals Consulted

ICTD – Information and Communication Technologies and Development
 ITID – Information Technologies & International Development
 EJISDC – Electronic Journal of Information Systems in Developing Countries
 ITD – Information Technology for Development
 AJIC – African Journal of Information and Communication
 AJIS – African Journal of Information Systems

Other Journals Consulted:

International Journal of Information Management
 Industrial Management and Data Systems
 Third World Quarterly
 Future Generation Computer Systems
 Behaviour and Information Technology
 International Journal of Computer Science and Information Security
 IEEE Computer Society Publications

APPENDIX – 2

Interview Questions Template for SaaS Cloud use

1. Do you use (or have you previously used) any software applications to support the services you offer and management of daily schedules? e.g. billing or accounting, emails, etc.
2. If yes, Please describe this software application in terms of the soft and hardware requirements needed for its proper functioning

3. Can you also tell me how the use of these software applications has aided in achieving your organization's objectives?
4. How did you acquire the software apps you use?
5. Are these applications installed on your network systems (in-house)?
6. Do you use any software applications remotely on (via) the internet?
7. If yes, can you describe the software app and how it was deployed and now delivered to you via the internet?
8. How secure do you think any information/data you keep on the internet is?
9. What about privacy and trust issues?
10. Can you further describe the network infrastructure on this premise, for instance, intranet, servers and storage etc.
11. How secured will you say are your in-house servers and storage when compared to internet delivered services of same
12. What about data loss issues?
13. If you do not use remote applications delivered through the internet, have you heard about or used any software apps e.g. Google apps, Microsoft 365, SharePoint, etc. before?
14. Does cloud computing mean anything to you?
15. What about software as a service?
16. What challenges do you face while accessing the cloud hosted services or apps via the internet? (e.g. Hard/software or service provider related?)
17. What personal challenges or threats do you feel the use of these cloud hosted apps have posed or will pose to you in the nearest future?
18. Can you briefly compare the experience you've had in using software apps delivered remotely on the internet to when these apps were installed in house? (e.g. in managing software upgrades and maintenance, cost, etc.)
19. What are some of the things that you have really liked about the use of this new apps and how they are deployed?
20. Describe your roles in designing, implementing and deploying the cloud hosted software applications you use?
21. So far, what has been the greatest accomplishment the use of cloud hosted applications has derived?
22. Based on your experience, what would you say are the strength of using software apps hosted in the cloud as opposed to in-house maintained software apps by enterprises like yours?
23. How effective or efficient do you think the use of software apps hosted in the cloud has been to your enterprise?
24. Can you describe the services you offer and how cloud hosted apps come in handy in the delivery of these services? (e.g. to your clients, government, etc.)
25. From your experience, what factors influence or encourage enterprises like yours to use software applications hosted in the cloud?
26. What about those factors that will discourage such use?
27. What other impact has the use of cloud hosted software applications had on your enterprise?
28. How have government policies on enterprises like yours affected the ability to use (or not) cloud hosted software applications (outsourced) from foreign companies? (e.g. In terms of support, restrictions, etc.)
29. Where do/did you get information about new technologies from?
30. How long have you been using the software application(s) remotely?

About your Enterprise

1. What is the size of this enterprise?
2. What is the name of your department and how many people do you work with?
3. Any idea about your customer base?
4. How is decision making organized?
5. Who is in charge of design/implementation/deployment of Information Systems in the enterprise?

About You

1. Can you tell me your full name and age?
2. What is your role/position in this enterprise? (Management/technical staff)
3. How long have you been working with your current organization (in this position)?
4. What experience or formal qualifications do you have?
5. When did you qualify for this role?